Nicole D. Jackson, Ph.D.

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Professional Summary

- Climate risk and infrastructure analytics leader with 10+ years applying machine learning, statistics, and systems analysis to extreme-weather impacts on energy, water, and food systems.
- Principal Member of the Technical Staff at Sandia National Laboratories, translating climate, hazard, operational, and asset-level data into decision-ready risk insights.
- Technical focus: spatio-temporal modeling, probabilistic prediction, tail risk, stochastic scenario generation, uncertainty quantification, and applied AI.
- 44 peer-reviewed publications, 1 pending patent, $3.9M managed of $15.7M in secured funding, IEEE Resilience Week 2025 Best Paper, and National Academies committee service.

Professional Experience

Sandia National Laboratories, Albuquerque, NM — 11/2019–Present
Principal Member of the Technical Staff — 04/2025–Present
Senior Member of the Technical Staff — 07/2021–04/2025
Postdoctoral Appointee — 11/2019–07/2021

Climate Risk and Infrastructure Impact Modeling

- Built spatio-temporal Markov random field models to estimate outage probabilities following compound wildfire and flood events in California and Texas.
- Applied outage probabilities in a Texas capacity expansion use case to evaluate grid reliability under extreme-event scenarios.
- Fused outage records, storm reports, and gridded reanalysis across 3,000+ U.S. counties to characterize outage drivers.
- Quantified solar generation impacts across 186 sites in 16 states using reanalysis, station observations, and storm-event data.
- Measured solar generation impacts from hurricanes (−12.6%), snow (−54.5%), and storms (+1.1%) to support renewable energy risk assessment.
- Developed wildfire smoke solar loss model ($R^2 = 0.91$) with average smoke-driven derates of 8.3% across 53 sites.
- Modeled drought-driven water allocation trade-offs using multi-decadal hydrologic data across Texas basins.

AI, Statistical Modeling, and Scenario Generation

- Principal Investigator, EPIC PLANN ($1.4M): developing graph-based reservoir computing for sub-seasonal, watershed-scale drought prediction across western U.S. basins using the 4-km CONUS404 reanalysis.
- Demonstrated preliminary skillful drought forecast horizons of ∼13 weeks in select western U.S. basins.
- Co-invented Graph Reservoir Networks for prediction of spatiotemporal systems (patent 19/550,784 pending).
- Developed LSTM emulator of monthly water allocation behavior (MSE = 0.034) for rapid hydrologic-extreme scenario evaluation.
- Generated 21,000 climate-informed streamflow sequences using Bayesian HMMs to evaluate water allocations under extremes.
- Co-developed 50,000 GAN-based synthetic extreme weather scenarios to stress-test power-system tail behavior.
- Applied Random Forest and LIME methods in R to identify weather, operational, and metadata variables associated with low solar performance.

Research Leadership and Translation

- Directed 8 multi-hazard modeling projects for national laboratories, universities, and industry partners.
- Led 2–7 person cross-disciplinary teams to deliver milestones, budgets, technical reports, and stakeholder briefings.
- Managed $3.9M in research funding within a $15.7M portfolio spanning climate risk, grid resilience, energy-water systems, and applied AI.
- Processed 50,000+ O&M records from 800+ solar sites in 24 states and integrated weather and storm data.

University of Illinois at Urbana-Champaign, Graduate Research Assistant 2014–2019

- Built probabilistic global maps of crop-specific areas and a framework quantifying crop exposure to temperature and moisture extremes for 17 crops over 50+ years.
- Conducted network analysis of global food trade dynamics to evaluate how climate shocks in production regions propagate through agricultural systems.
- Produced 4 journal papers and 2 public datasets from interdisciplinary research linking climate variability, water resources, agriculture, and trade.

Technical Skills

- **R**: primary for statistical modeling: tidyverse, caret, lime, extRemes, shiny.
- **Python**: pandas, geopandas, NumPy, SciPy, statsmodels, NetworkX, PyTorch, ReservoirPy, SHAP, git.
- **AI / Machine Learning**: Random Forests, LSTM, reservoir computing, graph reservoir networks, Bayesian HMMs, Markov random fields, explainable AI.
- **Statistical methods**: extreme value analysis, tail risk, spatio-temporal modeling, stochastic scenario generation, probabilistic prediction, uncertainty quantification.
- **Data**: gridded reanalysis and climate model output, station observations, storm-event records, outage data, asset-level performance data, hydrologic records, operational logs.
- **Domains**: climate risk, critical infrastructure resilience, renewable energy, electric grid reliability, drought and hydrologic prediction, energy-water systems, agricultural climate exposure.

Selected Recognition

- **Best Paper Award**, IEEE Resilience Week (highest reviewer score among all accepted papers) 2025
- **Member**, National Academies Committee on "Attribution of Extreme Weather and Climate Events and their Impacts" 2024–2026
- **Most Promising Engineer in Industry Award**, Black Engineer of the Year Awards 2024
- **MGB-SIAM Early Career Fellow** (1 of 10, inaugural class) 2022–2024

Education

- **Ph.D., Civil Engineering**, University of Illinois at Urbana-Champaign 2020
- **M.S., Materials Science & Engineering**, University of Illinois at Urbana-Champaign 2014
- **M.S., Engineering Mechanics**, Virginia Tech 2008
- **B.S., Civil Engineering**, University of Illinois at Urbana-Champaign 2005